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Conclusion
- This series supports the safe use of these SBRT schemes, with effective biological doses, low toxicity in central tumors, low rate of rib fractures and excellent tolerance.
- Stereotactic radiotherapy is a feasible, safe, and effective procedure for the treatment of Stage I non-small-cell lung cancer or metastases. It promises high local control with a reduced overall treatment time.
- Tumors with high initial SUV had higher rate of local relapse.

EP-1394 SABR for T2 Tumors of Lung

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Purpose or Objective
To assess dosimetric and clinical outcomes for relatively large and mobile T2 tumors of lung.

Material and Methods
All patients diagnosed with histologically confirmed T2N0M0 non-small cell lung cancer (NSCLC) suitable to undergo SABR based on multi-disciplinary tumor board, underwent respiratory training consisting of DIBH on demand for 15-25 seconds at a time. Patients underwent 2 sets of immobilization and imaging, one in DIBH phase and other in free breathing (FB) phase. Respiratory monitoring was performed using Varian RPM system and a 4mm gating threshold window was allowed. Set-up verification was performed using KV imaging and gated cone beam CT both taken in DIBH/FB depending on the type of treatment. All except 4 patients were treated with 2-4 arc VMAT using 6MV flattening filter free (FFF) photon beams to a dose of 60Gy in 5-8 fractions in DIBH. Rest were treated in FB phase. Follow-up imaging was performed at 3 months interval till 9 months and then yearly thereafter. For each patient, DIBH plans were dosimetrically compared to FB plans.

Results
A total of 33 patients with median age of 63 years diagnosed with T2N0M0 (staged with PET and EBUS) found suitable for SABR during the study period. With a median follow-up of 30 months, 3 yrs local control was 90% and overall survival was 81%. None of the patients had significant (>3 grade) early toxicities. 2 patients had grade-3 pneumonitis and 3 patients had grade-3 chest wall pain due to rib fractures. DIBH resulted in 1.63 times higher mean lung volumes (3956cc vs. 2511cc, p=0.002). Compared to ITV based contours, PTV volumes were 1.51 times smaller in DIBH CT compared to FB CT (35.98 cc vs. 53.68 cc, p=0.002). All the plans accepted for delivery met the standard criteria for both target and OAR constraints. On an average, V20 was reduced by 30%(17-39) in DIBH plans compared to FB plans. Time taken to deliver each session in DIBH phase with FFF beams was longer by an average of 2 minutes due to interruptions (maximum 4 interruptions/arc each lasting <15 seconds). Daily mean setup errors in cm quantified on CBCT were 0.1, 0.2 and 0.1 in vertical, longitudinal and lateral dimensions respectively and a uniform margin (based on Van Herk's formula) of 4mm appears to be safe.

Conclusion
SABR is clinically deliverable and results in good clinical outcomes in T2 lung tumors. DIBH based SABR is dosimetrically superior to FB based SABR and is feasible in a great majority of the patients. DIBH-CBCT based verification is reproducible and effective in reducing setup errors. A margin of 4 mm is safe in DIBH setting with 4 mm gating threshold window.

EP-1395 Long term results and technology impact of 48 Gy SABR for inoperable peripheral stage I lung cancer

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Purpose or Objective
Retrospective evaluation of the outcome of patients treated with SABR with curative intent for peripheral stage I lung cancer.

Material and Methods
In 2007, a SABR protocol was launched for patients with stage I NSCLC. Patients with central lesions, multiple nodules, metastatic lung lesions or synchronous cancers were excluded from this review. A diagnostic PET-CT was obtained for all patients.The prescribed dose was 4 fractions of 12Gy to a total dose of 48Gy for all patients.In 2010, the treatment technology evolved for 3 phases to 10 phases 4D-CT,from type I to type II dose calculations,from multiple conformal beams to VMAT, from movie portal images or megavoltage scans to systematic use of CBCT scan as IGRT method. Local control was defined as the absence of progression.All suspected local relapses were considered as confirmed.Toxicities were graded according to the CTCAE v4.0.

Results
Between 11/2007 and 06/2016, 300 patients were treated according this SABR protocol. 67 patients treated for metastases, 44 patients treated for multiple nodules and synchronous cancers were excluded, the 189 remaining patients were treated with SABR for a single primary lung lesion. Patients were 46 to 90 years-old, 66% were men, 93% were smokers or ex-smokers. Diagnosis was histologically confirmed in 41% patients (21% adenocarcinoma, 14% SCC, 6% NOS NSCLC), while it was based on radio-metabolic criteria including size increase in 59% patients. AJCC 7 Stage distribution was:T1a: 59%, T1b: 30%, T2: 11%, all patients were N0 and M0. Contra-indications to surgery were mostly pulmonary, cardiac, and/or general; only 4% of the patients refused surgery. After 4.1 years of median follow up, the cumulative incidence (analyzed in a competing risks framework) of local, regional and metastatic relapse are respectively 12%, 6% and 16%. After one, two and four years, the OS (estimated with Kaplan-Meier method) was respectively 83 %, 65 % and 37% while the RFS was respectively 75%, 49% and 31%, with a median OS of 37 months. No grade 4 or 5 toxicities were observed. Grade 1 to 3 toxicities were: fatigue (41%), chest wall pain (10%), dyspnea (7%), radiation pneumonitis (total: 4%, grade 3: 2%), dermatitis (4%), cough (3%), rib fracture (2%), and esophagitis (1%). Metastatic control was significantly better for patients without a previous cancer history (70% versus 59%, cause specific hazard ratio for metastatic relapse 3,04; CI 1,21-7,66, p = 0.02). We did not detect an impact of tumor stage on survival or loco-regional or distant control. The

local control improved for the recent period from 81% to 91 %, raising the hypothesis of favorable impact of new technologies (cause specific hazard ratio for local relapse 0,39, CI 0,15-1,01, p=0,05).

Conclusion

Local control and other clinical outcomes after SABR for peripheral Stage I lung cancer in this large series of frail patients compares to other reports. Further studies are needed to confirm the positive effect observed with the use of more recent radiation methods.

EP-1396 Outcome of Lung Metastases Receiving <30 Gy Stereotactic Body Radiation Therapy in a Single Fraction

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Purpose or Objective

For patients with early-stage primary lung cancer and/or oligometastatic lung tumors of extrapulmonary histology, surgery is the accepted primary treatment approach. However, for those who are medically inoperable or refuse resection, stereotactic body radiation therapy (SBRT) is an alternative treatment producing excellent local control (LC). Given the results of Trakul et al. (IJROBP 2012), showing equivalency of excellent (>90%) 1-year LC between single-fraction (18-25 Gy) and multi-fraction (50-60 Gy in 3-5 fractions) regimens, our institution has utilized 25 Gy in a single fraction (BED_{10} 87.5 Gy) for peripheral tumors ≤5 cm. We report clinical outcomes and toxicity of <30 Gy single-fraction SBRT.

Material and Methods

We conducted a retrospective review of all patients with lung metastases treated with single fraction, robotic SBRT at our institution from 2011-2016. 101 lung lesions from 36 patients were identified with median follow up 28 months (range, 7-74). For LC, patients were censored at last imaging (stable/improved) or time of progression. Kaplan-Meier and Cox proportional hazard analyses were performed.

Results

Median patient KPS was 90 (range, 70-100), with 88% of patients considered to be oligometastatic (1-5 lung lesions, and ≤1 extra-pulmonary sites treated definitively). 50% of patients were medically non-operable, while 50% refused resection. Primary cancer sites included bone/soft tissue sarcoma (27%), colorectal (25%), renal (14%), endometrial (13%), head and neck (8%), and other (13%). 27% of treated nodules had concurrent systemic therapy. Most lesions received 25 Gy (84%) or 20 Gy (11%) (range, 15-29). Median number of lesions treated per patient was 3 (range, 1-10). Median PTV was 4.8 cc (range, 0.5-85.5), all with PTV coverage ≥95%. LC (±SE) at 1 and 2 yrs, by nodule, was 67±5% and 49±6%, respectively. LC was diminished as a function of lesion size (cm) irrespective of PTV (HR 1.4±0.1, p<0.014), with 1 yr LC of 82±5% vs 48±8% for lesions ≤1 cm vs > 1 cm, respectively, p<0.001. LC was also reduced for adenocarcinoma vs others (HR 3.2±0.3, p<0.001). Median time to pulmonary progression (outside treated lesions) was 8 months (range, 0.4-52). Median time to extrapulmonary progression was 13 months (range, 0.4-48). Median OS was 32 months (7-74). AEs were rare, with 2 of 36 patients experiencing transient grade ≤2 pneumonitis after SBRT.

Conclusion

While single-fraction SBRT at <30 Gy was safe, LC per nodule was lower for larger lesions. 30 Gy single-fraction SBRT for lung metastasis was abandoned in a recent Phase 2 study due to decreased LC compared to multi-fraction regimens (Nuyttens et al. IJROBP 2015). Hamamoto et al. (Jap J Clin Oncol 2009) found worse LC for metastatic vs primary lung lesions at the same dose. Uncertainty in setup and tumor motion management may have contributed to diminished LC (Braunstein et al. IJROBP 2014). For metastases >1.0 cm and/or adenocarcinoma, higher BED_{10} regimens are strongly indicated, although may yield increased toxicity.

EP-1397 A single-centre experience of SBRT and EBRT in Stage I NSCLC patients: local failure and survival.

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Purpose or Objective

Stereotactic Body Radiotherapy (SBRT) has become the standard radiation therapy for inoperable stage I non-small cell lung cancer (NSCLC) patients. We analyse retrospectively the results of survival and local control in two series of 25 and 48 patients treated with conventional radiation therapy (EBRT) and stereotactic body radiotherapy respectively at our centre.

Material and Methods

From May 2006 to February 2010, 90 patients were treated with EBRT (66Gy, 33 fractions) inside a Spanish national phase II trial which compared EBRT against EBRT combined with erlotinib. At our centre, 25 patients were stage I NSCLC (13 had treatment combined with erlotinib, 52%). All of them had histological proven NSCLC T1-T2aN0M0. After its introduction in 2011, SBRT became the standard treatment for this group of patients. From August 2011 to September 2016, 48 patients were treated with SBRT (48-60Gy in 3-8 fractions), only 26 with NSCLC histological confirmation (55.2%). We compared retrospectively both local control and overall survival (OS) for these two groups of patients using Kaplan Meier from SPSS20.

Results

Local control at 1-year in SBRT group was 97.5% versus 65.4% in the EBRT group and at 3-years 87.8% versus 45%, respectively (p < 0.05). The median OS was 31.5 months versus 15 months for SBRT and EBRT, respectively, with an OS of 81% and 64% for SBRT and EBRT at 1- year respectively, and at 3-year 56% and 4% (p<0.05).